We claim:

1. A process for preparing oligomers of alkenes having from 4 to 8 carbon atoms from a feed stream comprising such alkenes or hydrocarbon streams in which such alkenes are present over a nickel-containing, heterogeneous catalyst in n successive adiabatically operated reactors, where n is 2 or an integer greater than 2, at from 30 to 280°C and pressures of from 1 to 300 bar, where the feed stream has a temperature T_{in} when it enters the first reaction zone, experiences a temperature increase in each reaction zone and, if this temperature increase is more than T_{in} + 20°C, is brought to a temperature in the range $T_{in} \pm$ 20°C before it enters a subsequent reaction zone, wherein the feed stream is divided and the feed substreams obtained in this way are fed to the 2 reactors, or if more than 2 reactors are used to at least 2 of the reactors, with addition of fresh feed in such a way that the temperature in one of the reactors is at most 20°C higher than that in each of the other reactors used.

2. A process as claimed in claim 1, wherein T_{in} is in the range from 20 to 120°C.

3. A process as claimed in claim 1 or 2, wherein the temperature in one of the reactors is at most 10°C higher than that in each of the other reactors used.

4. A process as claimed in any of claims 1 to 3, wherein the proportion of oligomers in the feed stream and in the feed substreams does not exceed 30% by weight.

5. A process as claimed in any of claims 1 to 4, wherein the feed stream and the feed substreams is/are reacted in condensed form.